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AQUATIC INSECTS OF LAKE JOCASSEE CATCHMENT IN NORTH AND SOUTH CAROLINA, WITH DESCRIPTIONS OF FOUR NEW SPECIES OF CADDISFLIES (TRICHOPTERA)[1]

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Abstract: With the invitation and support of Duke Power Company, aquatic insects were collected in North and South Carolina streams above Lake Jocassee from April through October 1987. A variety of collecting equipment and techniques were used including all-night light traps, 24-hour Malaise traps, qualitative examination of benthic materials, benthic nets, and aerial nets. At least 185 taxa were identified in the orders Ephemeroptera, Odonata, Plecoptera, Coleoptera (Elmidae only), and Trichoptera by cooperating taxonomic specialists who recognized among them 32 species that are rare, endemic, or of limited distribution, including four new species of Trichoptera. These four species in the genera *Agapetus* (Glossosomatidae), *Hydroptila* (Hydroptilidae), *Wormaldia* (Philopotamidae), and *Helicopsyche* (Helicopsychidae) are described and compared with closely related species.

Key Words: endemic species; endangered species; *Agapetus*; *Helicopsyche*; *Hydroptila*; *Wormaldia*; Glossosomatidae; Helicopsychidae; Hydroptilidae; Philopotamidae.

INTRODUCTION

In March 1987, in anticipation of requesting a license for a pumped-storage electric generating facility on Coley Creek above Lake Jocassee in Oconee County, S.C., and Transylvania County, N.C., Duke Power Company of Charlotte, N.C., requested a study "to determine the species composition of the adult aquatic insect fauna and the presence of species which could be rare, endemic, or of limited distribution in the area." To that end, entomologists from Clemson Uni-

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versity collected insects on 11 April, 28–29 April, 18 May, 15–16 June, 21 July, 25 August, 15 September, and 13 October 1987. Collection sites included Thompson River (Duke Power Company locality #583.2), Coley Creek (DPC #584.4 and 584.6), Bearcamp Creek (DPC #585.3), Limberpole Creek (north fork at South Carolina route 130), Howard Creek (DPC #577.0), Corbin Creek [2.4 highway km (1.5 mi.) north of Whitewater River bridge at North Carolina route 281], and Whitewater River (DPC #582.1). Collection methods involved using all-night ultraviolet light traps, 24-hour Townes traps, qualitative examination of benthic materials, bottom disturbance and benthic net sampling, aerial sweeping of vegetation, and aerial net stalking.

Insect groups which have been identified by the South Carolina Wildlife and Marine Resources Department, the North Carolina Department of Natural Resources and Community Development, and the United States Department of Interior as including species that may be threatened or endangered were specifically investigated: Ephemeroptera, Odonata, Plecoptera, Coleoptera (Elmidae only), and Trichoptera. For this study, only specimens from the localities that potentially will be impacted from Duke Power Company's proposed Coley Creek Project were studied (sites #583.2, 584.4, 584.6, and 585.3). Except for a representative collection held at Duke Power Company, all non-type specimens, whether studied at this time or not, are being retained as voucher material in the Clemson University Arthropod Collection (CUAC). Type specimens are deposited in the U.S. National Museum of Natural History (USNM) or in the CUAC as indicated.

RESULTS

Taxonomic consultants (noted in acknowledgments) identified at least 185 taxa (Table 1) among the orders and localities studied, specifically recognizing 18 species which they considered "rare, endemic, or of limited distribution" in the 32 collections examined including four species of caddisflies that are new to science and are known from nowhere else. Additionally, 13 other species are currently under formal consideration by the South Carolina Heritage Trust Program for "species of concern" status and one other species of Coley Creek stoneflies is listed in the Federal Register (Anonymous, 1984) in Category 2. In general, species in the federal Category 2 and the other species highlighted above are those that may or may not be endangered, but for which distribution and habitat data are not yet sufficient to list them as such in North Carolina, South Carolina, or nationally. The 32 species of particular concern are noted with an asterisk in Table 1.

The new species of caddisflies (Trichoptera) described below are illustrated in Figures 1–5. Abbreviations used with those illustrations are as follows:

For genitalia:

VIII = abdominal segment VIII
IX = abdominal segment IX
X = abdominal segment X
gon.pl. = female gonopod plate
inf.ap. = male inferior appendage
sp.scl. = female spermathecal sclerite
sup.ap. = superior appendage (either gender)

For wings:

I = Fork I (fork of S_{1+2})
II = Fork II (fork of S_{3+4})
III = Fork III (fork of M_{1+2})
V = Fork V (fork of Cu_{1+2})
A = anal vein
E = empusal vein
M = median vein
P = plical vein
R = radial vein
S = sectoral vein
Sc = subcostal vein

Authors of the particular species are as indicated.

Family GLOSSOSOMATIDAE

Agapetus (*A.*) *jocassee* Morse n. sp.

MALE: Length 4.9 mm (4.7–5.1 mm, n = 3), forewing 4.2 mm (4.1–4.4 mm, n = 3). Head and thorax of specimens in alcohol dark brown except warts light brown; wings and appendages light brown. Structure typical of subgenus (Ross, 1956).

MALE GENITALIA (Fig. 1): Sternum V with pair of glandular openings laterally (similar to those of *A. pinatus* Ross, 1938; Ross, 1956, fig. 358D). Sternum VI with median spine-like projection blunt, about one-third as long as sternite. Segment IX with tergum short, pleural regions long and rounded anteriorly and posteriorly with setae posteriorly, and sternum slightly incised anteriorly and slightly projecting posteriorly. Superior appendages slightly clavate, about eight times as long as broad, with long setae arranged in a dorso-lateral row. Segment X mostly membranous except ventro-lateral edges strongly sclerotized, terminating in two pairs of dark sclerous points, with dorsal points variously curved downward or posteriad and, in holotype, positioned slightly laterad of ventral points, mesad in paratypes. Inferior appendages in lateral view about six times as long as broad, nearly parallel-sided, with diagonal concavity laterally at mid-length, and with rounded apex; in ventral view each with ridge ventro-mesally at midlength nearly one-third as long as appendage, serrate along distal half of ridge, and with one or two short and dark sclerous points subapico-mesally. Phallus with roof-like phallobase internally, open ventrally; phalicata tubular, straight, slightly capitate, about 18 times as long as broad.

HOLOTYPE: Male. NORTH CAROLINA: Transylvania County, Coley Creek at North Carolina–South Carolina border, Duke Power Company locality #584.6, 1,700 ft. [518 m] altitude, 20–21 July 1987, ultraviolet light, S. W. Hamilton and K. M. Hoffman collectors, USNM.

PARATYPES: NORTH CAROLINA: Transylvania County, Bearcamp Creek at 1,400 ft. [426 m] altitude, Duke Power Company locality #585.3, ultraviolet light, 15–16 June 1987, S. W. Hamilton and K. M. Hoffman collectors, 1 female, USNM. SOUTH CAROLINA: Oconee County, Coley Creek at 1,440 ft. [439 m] altitude, Duke Power Company locality #584.4, ultraviolet light, 15–16 June 1987, S. W. Hamilton and K. M. Hoffman collectors, 2 males, CUAC. Same locality, 11 June

Table 1

Temporal and spatial distribution of the Ephemeroptera, Odonata, Plecoptera, Coleoptera (Elmidae), and Trichoptera of Lake Jocassee catchment, April to October 1987. * = rare, endemic, or of limited distribution.

Species	Duke Power Company Locality Numbers and Streams			
	583.2 Thompson	584.4 Coley SC	584.6 Coley NC	585.3 Bearcamp
Ephemeroptera				
Ameletus sp.	May	0	0	0
**Baetis flavistriga* McDunnough	May–July	April–June	0	May–July, Sept
**Baetis hageni* Eaton	0	April–July, Sept	May–July	June, Sept
Baetis sp.	April–May, July	0	0	0
Centroptilum rivulare Traver	July–August	0	0	0
Centroptilum sp.	May–June	0	0	June
Cloeon sp. A	June	0	0	0
**Epeorus (Iron) dispar* (Traver)	May	0	0	0
Epeorus (Iron) rubidus (Traver)	May–Sept	May–Sept	April–May, Sept	April–Sept
Epeorus (Iron) sp.	0	May	0	May
Epeorus (?) sp.	July	May–July	April	0
Ephemera blanda Traver	May–July	July	July–August	June–July
Ephemerella (?) sp. A	May–June	May	0	May–June
Ephemerella (?) sp. B	June–July	June–July	May	May–June
Ephemerella (?) sp. C	May	0	0	0
Habrophlebia vibrans Needham	June	0	0	0
Habrophlebioides americana (Banks)	June	July–August	June, August	June
Heptagenia julia Traver	June–July	August	0	0
Heptagenia marginalis Banks	June–July, Sept	June–July	0	September
Heptagenia townesi Traver	0	June	0	June
Heptagenia sp.	0	July	0	0
Heterocloeon sp.	June	0	0	0
Hexagenia munda Eaton	July, Sept	0	0	July
Isonychia sayi Burks	July–Sept	August–Sept	0	September
**Isonychia similis* Traver	July, Sept	August–Sept	July–Sept	July–Sept

Table 1
Continued.

Species	Duke Power Company Locality Numbers and Streams			
	583.2 Thompson	584.4 Coley SC	584.6 Coley NC	585.3 Bearcamp
**Leucrocuta juno* (McDunnough)	June–July, Sept	May–June	0	June
**Leucrocuta minerva* (McDunnough)	0	0	0	July
Paraleptophlebia guttata (McDunnough)	June–July	May–June, Aug	0	May, July
Paraleptophlebia volitans (McDunnough)	June	0	0	0
Paraleptophlebia sp.	June–July	May, July	May–June	May
**Pseudocloeon bimaculatum* Berner	July	0	0	0
Pseudocloeon sp.	May–July	April–May	0	0
**Stenacron pallidum* (Traver)	May–August	May	June–August	June–August
Stenonema carlsoni Lewis	0	0	0	July
Stenonema modestum (Banks)	July–August	May, July–Sept	Apr, July–Sept	June–July
Stenonema pudicum (Hagen)	May–Sept	June	0	May–Sept
Odonata				
Boyeria grafiana Williamson	Sept–October	0	0	May
Boyeria sp. poss. *grafiana*	July	July	September	0
Calopteryx amata Hagen	0	0	0	October
Calopteryx maculata (Beauvois)	0	0	0	October
Cordulegaster maculata Selys	July	0	0	0
Cordulegaster sp. poss. *maculata*	August	July	July, Sept–Oct	Apr, June, Oct
Gomphus rogersi Gloyd	0	0	0	June–October
Lanthus vernalis Carle	July	Apr, July–Oct	August–Oct	Apr–June, Oct
Stylogomphus abistylus (Hagen)	October	0	0	June
Stylurus sp.	July–August	0	0	0
Plecoptera				
Acroneuria abnormis (Newman)	June–July	May–July	June–July	June
Acroneuria filicis Frison	0	July	0	July
**Acroneuria mela* Frison	0	June	0	0
Alloperla chloris Frison	July	0	0	0

Table 1
Continued.

Species	Duke Power Company Locality Numbers and Streams			
	583.2 Thompson	584.4 Coley SC	584.6 Coley NC	585.3 Bearcamp
Alloperla usa Ricker	0	May–June	0	May–June
Alloperla sp. A	0	July	0	0
Amphinemura wui (Claassen)	July	May–June, Aug	May–June, Aug	May–June, Aug
**Beloneuria georgiana* (Banks)	0	0	June–July	0
Cultus verticalis (Banks)	May	May	0	May
Diploperla duplicata (Banks)	0	May	0	0
Eccoptura xanthenes (Newman)	June–July	May–July	June–July	June–July
Haploperla brevis (Banks)	0	0	May	0
Isoperla holochlora (Klapalek)	May–July	May	June	May–June
Isoperla orata Frison	June–August	0	July	Apr, June–July
Leuctra alexanderi Hanson	0	April–May	April–May	April–May
Leuctra ferruginea (Walker)	September	August–Oct	June–Sept	June, Sept
Leuctra tenuis (Pictet)	July–Sept	July	September	July–October
Leuctra sp. A	May	April–May	May	0
Leuctra sp. B	May	0	0	April–May
Paragnetina immarginata (Say)	June–Sept	0	July	September
Paraleuctra sara (Claassen)	0	0	0	April
Perlesta frisoni Banks	June–August	June–August	June–August	June–July
Pteronarcys scotti Ricker	May	April	0	April
Sweltsa lateralis (Banks)	0	May	May	0
**Tallaperla anna* (Needham & Smith)	0	0	May	0
Tallaperla maria (Needham & Smith)	0	April–May	May	May
Coleoptera (Elmidae)				
**Optioservus immunis* (Fall)	July–Oct	July–Sept	Apr, July, Sept–Oct	June–July, Sept
Oulimnius latiusculus (LeConte)	July–Oct	July–Oct	Apr, July, Sept	July, Sept–Oct
Promoresia tardella (Fall)	July–Oct	July–Oct	April, June–Oct	June–Oct
Stenelmis sp. A	0	October	0	April, Sept–Oct

Table 1
Continued.

Species	Duke Power Company Locality Numbers and Streams			
	583.2 Thompson	584.4 Coley SC	584.6 Coley NC	585.3 Bearcamp
Trichoptera				
**Agapetus jocassee* Morse n. sp.	0	June	July	June
Agapetus sp.	June	0	0	0
**Agarodes griseus* Banks	June	0	0	0
**Agarodes tetron* Ross	May	0	0	0
Agrypnia vestita (Walker)	September	0	0	0
**Apatania praevolans* (Morse)	0	0	0	April
Apatania sp.	0	0	0	April
Arctopsyche irrorata Banks	April–May	April–May	0	April–May
Ceraclea diluta (Hagen)	June–July	0	0	0
Ceraclea nepha (Ross)	May	0	0	May
Ceraclea protonepha Morse & Ross	May–June	May	0	May
Ceraclea tarsipunctata (Vorhies)	May	0	0	May
Ceraclea sp.	May–July	0	May	May–June
**Ceratopsyche bronta* Ross	July	July–August	August	September
Ceratopsyche poss. *bronta* Ross	June	0	0	June
Ceratopsyche morosa Ross	May	0	0	0
Ceratopsyche poss. *morosa* Ross	0	0	0	June
Ceratopsyche slossonae (Banks)	June–July	July	July	0
Ceratopsyche poss. *slossonae*	May	June	0	June
Ceratopsyche sparna (Ross)	April–Oct	May–October	May–Sept	May–October
Ceratopsyche prob. *sparna*	April	0	0	May
Ceratopsyche sp.	0	0	May	0
Cernotina sp.	July	0	0	0
Cheumatopsyche etrona Ross	July	0	0	0
Cheumatopsyche geora Denning	June	0	0	0
Cheumatopsyche gracilis (Banks)	June	0	0	June
Cheumatopsyche gyra Ross	May, July	May	0	0

Table 1
Continued.

Species	Duke Power Company Locality Numbers and Streams			
	583.2 Thompson	584.4 Coley SC	584.6 Coley NC	585.3 Bearcamp
Cheumatopsyche halima Denning	June	0	0	0
C. harwoodi enigma Ross et al.	May–Sept	May	May	May–June, Aug–Sept
Cheumatopsyche minuscula (Banks)	June–July	0	0	0
Cheumatopsyche oxa Ross	May, Aug–Sept	August	July	May–July, Sept
Cheumatopsyche pasella Ross	June–July	0	0	June
Cheumatopsyche pettiti (Banks)	May–July, Sept	May, July	July	May–June
Cheumatopsyche pinaca Ross	June–Sept	May–Sept	0	May–July, Sept
Cheumatopsyche sp.?	0	August	0	0
Chimarra aterrima Hagen	0	0	0	June
Chimarra augusta Morse	July	0	0	0
Chimarra prob. *augusta*	July	0	0	0
Chimarra socia Hagen	0	0	0	June
Chimarra sp.	May	0	0	0
Cyrnellus fraternus (Banks)	0	July, Sept	0	July
Diplectrona modesta Banks	May–Sept	May–Sept	May–Sept	May–Sept
Dolophilodes distinctus (Walker)	April, June–Oct	May–October	May–Sept	April–Oct
Dolophilodes prob. *distinctus*	0	August	0	0
Dolophilodes major (Banks)	0	May–July	May–August	June
Dolophilodes prob. *major*	0	0	August	0
Fattigia pele (Ross)	May	May	May	May
Glossosoma nigrior Banks	May–Sept	May, July–Sept	0	May–Sept
Glossosoma prob. *nigrior*	June	July	0	May
Glossosoma sp.	May	0	0	0
Goera calcarata Banks	June–August	June	0	June–July
**Goera fuscula* Banks	May	May	June	0
**Helicopsyche paralimnella* Hamilton n. sp.	June–July	0	0	0
Heteroplectron americanum (Walker)	0	0	0	May
**Hydatophylax argus* Harris	June	0	0	0

Table 1
Continued.

Species	Duke Power Company Locality Numbers and Streams			
	583.2 Thompson	584.4 Coley SC	584.6 Coley NC	585.3 Bearcamp
Hydropsyche betteni Ross	June, August	June, August	August–Sept	June–July, Sept
Hydropsyche prob. *betteni*	May, July	May, September	0	May–June
**Hydropsyche carolina* Banks	June–July	June	0	June
Hydropsyche venularis Hagen	July	0	0	0
Hydropsyche sp.	July	July	0	April, June
Hydroptila callia Denning	July–August	0	0	0
Hydroptila fiskei Blickle	0	0	0	May
Hydroptila gunda Milne	September	0	0	September
Hydroptila hamata Morton	May, July–Aug	0	0	May
**Hydroptila englishi* Hamilton n. sp.	August	0	0	0
Hydroptila quinola Ross	July–Sept	0	0	0
**Hydroptila talladega* Harris	May	May	0	May
**Hydroptila tortosa* Ross	0	0	0	September
Hydroptila sp.	May–Sept	August–Sept	May	May–August
Ironoquia punctatissima (Walker)	0	October	0	0
Lepidostoma americanum (Banks)	June	0	0	June
Lepidostoma flinti Wallace & Sherberger	0	0	0	May
Lepidostoma griseum (Banks)	August–Sept	Sept–October	August–Sept	Sept–October
Lepidostoma poss. *griseum*	October	September	Sept–October	September
Lepidostoma latipenne (Banks)	May–Sept	May–October	May, July–Sept	May–October
Lepidostoma lydia Ross	0	May	May	0
Lepidostoma poss. *lydia*	0	0	0	July
Lepidostoma modestum (Banks)	April	April	0	May
Lepidostoma serratum Flint & Wiggins	0	Sept–October	0	October
Lepidostoma sp.	May, September	June	0	September
Lype diversa (Banks)	May–Sept	May–Sept	May–Sept	May–Sept
Matrioptila jeanae (Ross)	0	0	0	June
Mayatrichia ayama Mosely	0	August	July	0

Table 1
Continued.

Species	Duke Power Company Locality Numbers and Streams			
	583.2 Thompson	584.4 Coley SC	584.6 Coley NC	585.3 Bearcamp
Micrasema burksi Ross & Unzicker	0	April	0	May
Micrasema charonis (Banks)	May	0	0	May–June
Micrasema rusticum (Hagen)	May	0	0	0
Micrasema wataga Ross	July–August	0	0	June
Micrasema sp.	June–July, Sept	0	0	July
Molanna blenda Sibley	0	0	0	May
Molanna tryphena Betten	0	0	0	June
Nectopsyche candida (Hagen)	May–June	0	0	0
Nectopsyche prob. *candida*	July	May	0	0
Neophylax consimilis Betten	Sept–October	September	0	October
Neophylax mitchelli Carpenter	October	0	0	0
Neophylax sp.	October	0	0	0
**Neotrichia collata* Morton	July	0	0	0
Nyctiophylax celta Denning	June	0	0	0
Nyctiophylax denningi Morse	June–July	0	0	0
Nyctiophylax nephophilus Flint	June–July	June–August	June–August	June–July
Nyctiophylax sp.	June–July	0	July	September
Ochrotrichia confusa (Morton)	July–August	0	0	0
Ochrotrichia sp.	July	0	0	0
Oecetis avara (Banks)	July	0	0	0
Oecetis inconspicua (Walker)	May–July	May, July	0	May–June, Sept
Oecetis nocturna Ross	July	0	0	0
Oecetis persimilis (Banks)	May, July–Aug	0	0	May
Oecetis sphyra Ross	June	0	0	0
Oecetis sp.	0	May	0	0
Orthotrichia aegerfasciella (Chambers)	May, September	May	0	0
Oxyethira grisea Betten	May	0	0	May
Oxyethira michiganensis Mosely	June	July	August	June–July

Table 1
Continued.

Species	Duke Power Company Locality Numbers and Streams			
	583.2 Thompson	584.4 Coley SC	584.6 Coley NC	585.3 Bearcamp
Oxyethira zeronia Ross	September	0	0	0
Parapsyche apicalis (Banks)	0	July	0	0
Parapsyche cardis Ross	May	April–June	May–June	May–June
Parapsyche sp.	0	0	July	0
Phryganea sayi Milne	August–Sept	0	0	0
**Phylocentropus auriceps* (Banks)	0	0	0	May
Phylocentropus carolinus Carpenter	May–August	July	0	May–Sept
Phylocentropus lucidus (Hagen)	May	July–August	June, Aug–Sept	May–August
Phylocentropus placidus (Banks)	0	May	0	May
Platycentropus radiatus (Say)	0	June	0	0
Polycentropus cinereus Hagen	June–Sept	July–Sept	July–August	June–August
Polycentropus poss. *cinereus*	July–August	0	July	May
Polycentropus poss. *clinei* Milne	June	0	0	0
Polycentropus confusus Hagen	May–July, Sept	September	May	May–June
Polycentropus poss. *confusus*	0	June	0	0
Polycentropus maculatus Banks	May–August	June–Sept	September	July
Polycentropus sp.	0	0	July	0
**Psilotreta frontalis* Banks	June	0	0	0
Psilotreta sp.	0	0	May	0
Psychomyia flavida Hagen	May–Sept	May–June, Aug	June	May–Sept
Ptilostomis ocellifera (Walker)	July	0	0	July
**Pycnopsyche flavata* (Banks)	September	August–Sept	August–Sept	September
Pycnopsyche gentilis (MacLachlan)	October	October	October	October
Pycnopsyche luculenta (Betten)	Sept–October	0	0	October
Pycnopsyche scabripennis (Rambur)	0	Sept–October	September	Sept–Oct
Pycnopsyche sonso (Milne)	Sept–October	August–Oct	August–Oct	August–Oct
Rhyacophila atrata Banks	May	May	0	June
Rhyacophila carolina Banks	May–October	May–October	June	May–October

Table 1
Continued.

Species	Duke Power Company Locality Numbers and Streams			
	583.2 Thompson	584.4 Coley SC	584.6 Coley NC	585.3 Bearcamp
Rhyacophila fuscula (Walker)	May–October	May–June, Aug–Oct	April–Sept	May–October
Rhyacophila glaberrima Ulmer	August–Oct	August	July–Sept	0
Rhyacophila prob. *glaberrima*	July, Sept	0	0	0
Rhyacophila minora Banks	0	May	0	May
Rhyacophila nigrita Banks	May	May–June	May	April–May
Rhyacophila prob. *nigrita*	0	0	June	0
Rhyacophila teddyi Ross	July	May, July–Sept	May, July	June, Sept
Rhyacophila torva Hagen	June–July	June	June, August	June
Rhyacophila sp.	May	May	May–June	May–June
Setodes incertus (Walker)	June–July	0	0	0
Setodes stehri (Ross)	June	0	0	0
**Stactobiella delira* (Ross)	May	May	May	May
**Stactobiella martynovi* Blickle & Denning	June	0	0	June
Stactobiella sp.	0	0	0	April
Triaenodes ignitus (Walker)	May, July	0	May	0
Triaenodes prob. *ignitus*	0	May	0	May–July
Triaenodes marginatus Sibley	0	0	0	May
Triaenodes sp.	June	0	0	September
Wormaldia moesta (Banks)	Apr, June–July	May–August	June–August	May–August
**Wormaldia thyria* Denning	July	0	May	May
**Wormaldia oconee* Morse n. sp.	August	July	0	0

1986, T. C. Folsom collector, 1 female, CUAC. Same locality, 1 July 1986, T. C. Folsom collector, 1 male pupa and 2 female pupae, CUAC.

ETYMOLOGY: "Jocassee" (Cherokee), name of the late community of Jocassee and the present Lake Jocassee in whose catchment the species apparently is endemic.

DIAGNOSIS: This species is a member of the Nearctic *Agapetus* (*A.*) "*Celatus* Group" (Ross, 1956), as evidenced in the males by the glandular openings on sternum V, the more heavily sclerotized ventro-lateral margins of tergum X, and the presence of obvious superior appendages. Among these species it most closely resembles *A. avitus* Edwards, 1956 (Harris, 1984) and *A. iridis* Ross, 1944 in possessing two pairs of dark, sclerous points apically on tergum X and two groups of dark sclerous points on the mesal surface of each inferior appendage. Like *A. iridis* the inferior appendages are parallel-sided in lateral view and like *A. avitus* these are rounded apically, but the inferior appendages of *A. jocassee* combine these two features uniquely and each has a diagonal concavity laterally not seen in the other two species. Furthermore, the pair of subapico-dorsal sclerous points of tergum X are curved upward in those two species, but downward in *A. jocassee.* No other known species of the *Celatus* Group has a ventro-mesal ridge at mid-length on each inferior appendage.

Family HYDROPTILIDAE

Hydroptila englishi Hamilton n. sp.

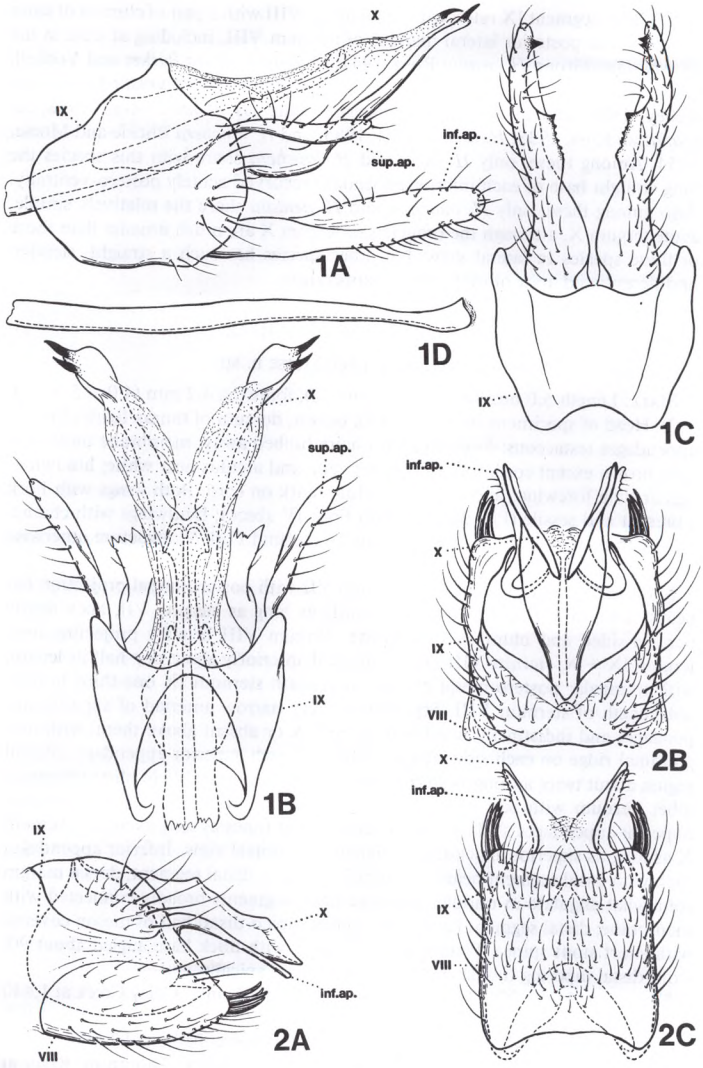
MALE: Length 2.7 mm, forewing 2.1 mm. Body of holotype cleared in KOH. Filaments of glandular tufts of vertex unbranched, spatulate. Structure otherwise typical of genus.

MALE GENITALIA (Fig. 2): Sternum VII with acute median spine about one-fourth as long as sternite. Sternum VIII with pair of clusters of dark, stout spines laterally, about four spines in each cluster. Segment IX synsclerotized, completely retracted within segment VIII, tergum very short, sternum as long as sternum VIII. Tergum X with mid-dorsal ridge basally, separating at midlength into pair of lateral lobes darkly sclerotized along dorsal edges, acute apically in dorsal and lateral views. Inferior appendages gradually tapered from base to apex, initially directed antero-dorsad, then recurved abruptly about 150° postero-ventrad (this distal recurved portion paralleling ventro-lateral edges of segment X closely), with lateral row of setae near apex; no bilobed process evident basally. Phallus of holotype lost; prior to its loss, SWH noted that it was very similar to phalli of *H. lonchera, lagoi,* and *ouachita* except for apparent lack of very thin apical portion, giving apex of phallus blunted appearance.

HOLOTYPE: Male. SOUTH CAROLINA: Oconee County, Thompson River at North Carolina border, about 1,440 ft. [439 m] altitude, Duke Power Company locality #583.2, ultraviolet light, 24–25 August 1987, K. M. Hoffman and W. R. English collectors, USNM.

ETYMOLOGY: This species is named in honor of one of its collectors, William R. "Rockie" English, an enthusiastic student of benthic ecology and a valued friend and colleague.

DIAGNOSIS: This species is a member of the *Hydroptila* "*Waubesiana* Group" of Marshall (1979). Several species of this group and of those she listed as "incertae



FIGS. 1, 2. Male genitalia of new species of Hydroptiloidea: 1. *Agapetus jocassee* Morse n. sp. 2. *Hydroptila englishi* Hamilton n. sp. A, left lateral view; B, dorsal view; C, ventral view; D, phalicata, left lateral view. Abbreviations as in text.

sedis" have segment IX retracted into segment VIII with a pair of clusters of stout spines on the posterior lateral margins of sternum VIII, including at least in the *Waubesiana* Group *H. acadia* Ross, 1941; *H. anisoforficata* Parker and Voshell, 1979; *H. ouachita* Holzenthal and Kelley, 1983; and *H. recurvata* Harris and Kelley, 1984; and in the species "incertae sedis" *H. dentata* Ross, 1938; *H. grandiosa* Ross, 1938; *H. lagoi* Harris, 1985; and *H. lonchera* Blickle and Morse, 1954. Among these, only *H. lagoi* and *H. lonchera* share with this species the long straight base of each inferior appendage recurved acutely postero-ventrally. Also among these, only *H. ouachita* and *H. dentata* share the relatively simple, acute tergum X, although the branches of tergum X are much broader than those of these species in lateral view. No other species has such a straight, slender, undifferentiated apex of each inferior appendage.

Family PHILOPOTAMIDAE

Wormaldia oconee Morse n. sp.

MALE: Length 5.0 mm (4.7–5.2 mm, n = 2), forewing 4.2 mm (4.0–4.5 mm, n = 2). Head of specimens in alcohol dark brown, dorsum of thorax lighter brown, appendages testaceous; forewings with hairs rubbed away, membrane uniformly light brown except cord, fork of median vein, and arculus near white; hindwings lighter than forewings and with near white mark on cord. Both wings with Fork I present and sessile (Fig. 3E) and with Fork IV absent; hindwings with characteristic three free veins (P, E + 1A, and 2A) behind Fork V. Structure otherwise typical of genus.

MALE GENITALIA (Fig. 3A–D): Sternum VII with postero-mesal projection beneath sternum VIII one-half to two-thirds as long as sternite VII, apex nearly parallel-sided and blunt or subtruncate. Tergum VIII broadly projecting over tergum IX + X; sternite VIII broadly incised anteriorly about one-half its length, with triangular postero-mesal projection beneath sternum IX one-third to one-half length of sternum VIII. Segment IX very narrow anteriad of superior appendages and indistinctly fused with tergum X or absent above them; with longitudinal ridge on each side laterad of base of each superior appendage; pleural region about twice as long as sternum IX, projecting anteriorly in blunt triangular lobe; sternum with pair of short, rounded projections posteriorly near meson. Superior appendages slightly clavate, about eight times as long as broad. Tergum X as long as superior appendages, triangular in dorsal view. Inferior appendages each with basal segment nearly 1.5 times as long as distal segment, dorsal margin somewhat angulate in middle, opposing basal segments broadly connected with membrane; distal segment nearly rectangular, apico-distal half of meson covered with short stout spines. Phallus pistol-shaped, with thick base angled about 90° from distal tapering tubular portion, subtruncate apically.

HOLOTYPE: Male. SOUTH CAROLINA: Oconee County, Coley Creek at 1,440 ft. [439 m] altitude, Duke Power Company locality #584.4, 20–21 July 1987, ultraviolet light, S. W. Hamilton and K. M. Hoffman collectors, USNM.

PARATYPE: Male. SOUTH CAROLINA: Oconee County, Thompson River at North Carolina border, about 1,440 ft. [439 m] altitude, Duke Power Company locality #583.2, ultraviolet light, 24–25 August 1987, K. M. Hoffman and W. R. English collectors, CUAC.

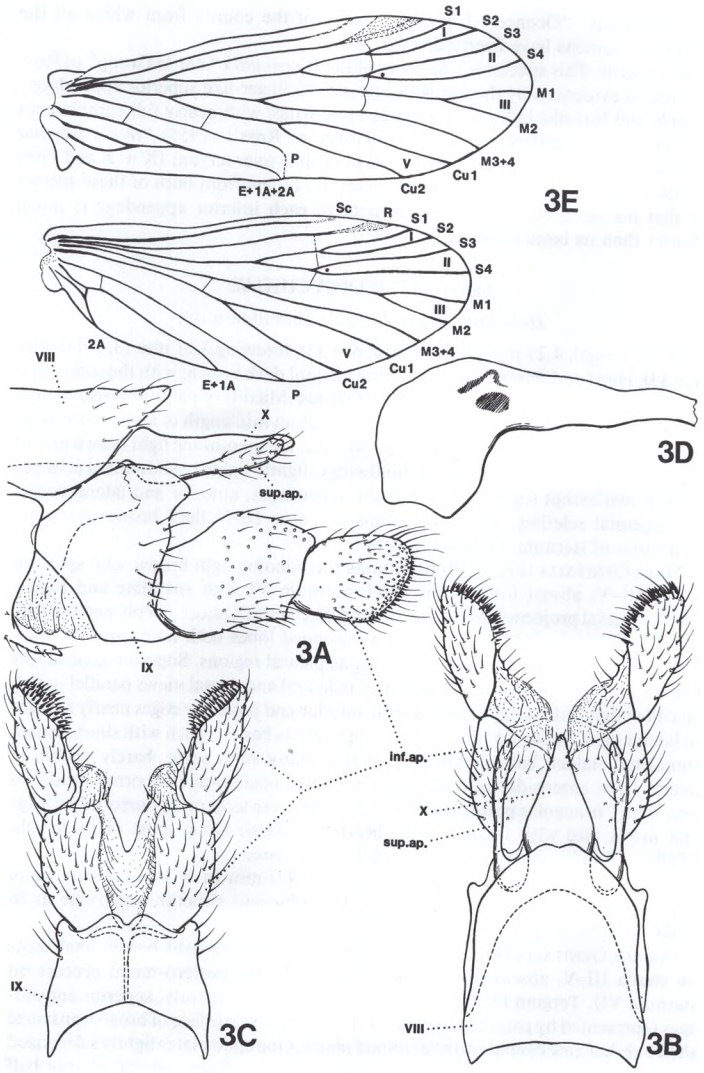


FIG. 3. Male genitalia and wings of *Wormaldia oconee* Morse n. sp. A–D, male genitalia; E, male wings. A, left lateral view; B, dorsal view; C, ventral view; D, phallus, left lateral view. Abbreviations as in text.

ETYMOLOGY: "Oconee" (Cherokee), name of the county from which all the known specimens have been collected.

DIAGNOSIS: This species is a member of the *Wormaldia* "*Anilla* Group" of Ross (1956), as evidenced by the triangular tergum X, finger-like superior appendages, simple and leaf-like inferior appendages, and wings with nearly full complement of veins. More particularly, it is a member of Ross's (1956) "*thyria-hamata* complex" in which tergum VIII projects hood-like over tergum IX + X and Fork IV (fork of M_{3+4}) is absent. *Wormaldia oconee* differs from both of these species in that for the former the distal segment of each inferior appendage is much shorter than its basal segment.

Family HELICOPSYCHIDAE

Helicopsyche paralimnella Hamilton n. sp.

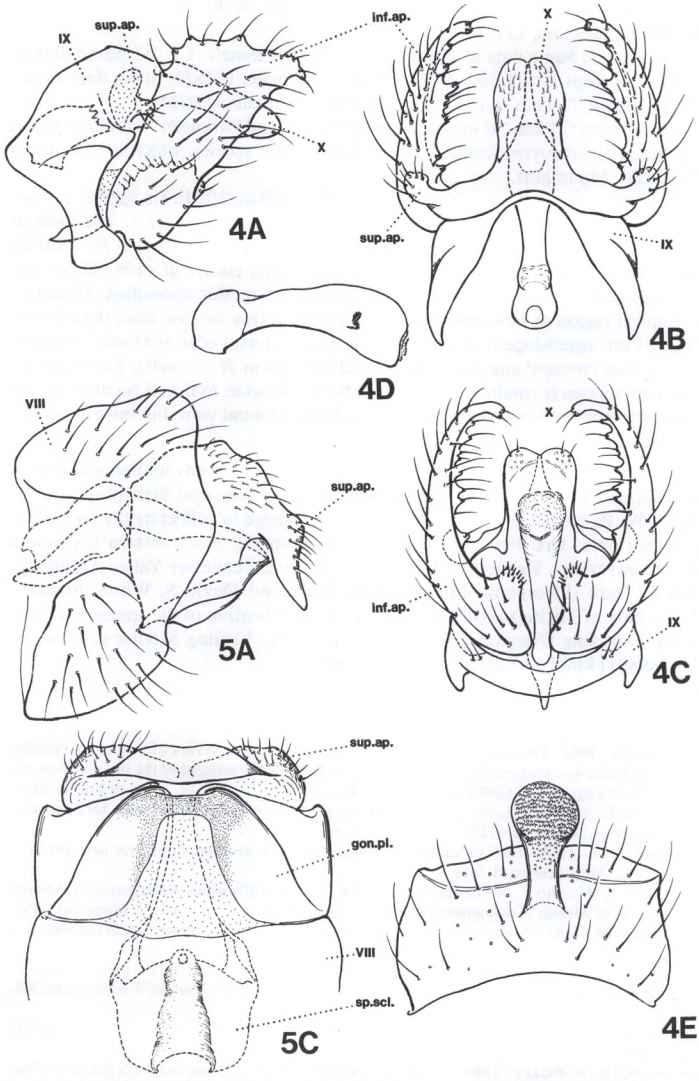
MALE: Length 4.27 mm (3.8–4.7 mm, n = 33), forewing 3.71 mm (3.4–4.0 mm, n = 33). Head and thorax of specimens in alcohol dark brown, with thoracic warts lighter brown. Appendages generally testaceous. Maxillary palpi two-segmented, the segments subequal in length, extending to about midlength of scape. Forewings densely clothed with uniformly dark brown hair, the membrane light brown except for near white cord and fork of M; hindwings slightly lighter. Abdominal sclerites light brown except segment IX, superior appendages, anterior and lateral costae of pregenital sclerites, and reticulations of sterna III–V dark brown, spatulate projection of sternum VI medium brown.

MALE GENITALIA (Fig. 4): Reticulations surrounding light brown setal spots on sterna III–V, absent from sternum VI. Sternum VI with spatulate and rugose postero-mesal projection as long as sternite. Segment IX short, deeply and broadly incised anteriorly, longest laterally with rounded lobes both anteriorly and posteriorly, sternum about one-third as long as pleural regions. Superior appendages short, slightly capitate, setose. Tergum X in lateral and dorsal views parallel-sided, apically blunt. Inferior appendages with anterior and posterior edges nearly straight in lateral view, about 1.5 times as broad apically as basally; each with short, broad, somewhat stalked baso-mesal lobe bearing many stout setae, barely visible in lateral view; antero-dorsal edge evenly rounded, postero-dorsal corner produced into sharp, triangular point; apex curved mesad over tergum X; dorso-mesal edge and mesal face with irregular, seta-bearing chalazae along most of its length. Phallus with clavate apex slightly broader than base.

FEMALE: Length 4.5 mm (n = 1), forewing 4.0 mm (n = 1). Maxillary palpi four-segmented, about as long as in male. Color and structure otherwise as in male.

FEMALE GENITALIA (Fig. 5): Reticulations surrounding light brown setal spots on sterna III–V, absent from sterna VI and VII. No postero-mesal process on sternum VII. Tergum IX deeply and broadly incised anteriorly, superior appendages represented by pair of low setose mounds on dorsal surface of broad transverse shelf overhanging caudal end of gonopod plates. Gonopod plates lightly sclerotized laterally and with slightly darker regions posteriorly. Spermathecal sclerite half as broad as gonopod plates.

HOLOTYPE: Male. SOUTH CAROLINA: Oconee County, Thompson River at North Carolina border, about 1,440 ft. [439 m] altitude, Duke Power Company



FIGS. 4, 5. Genitalia of *Helicopsyche paralimnella* Hamilton n. sp. 4. Male genitalia. 5. Female genitalia. A, left lateral view; B, dorsal view; C, caudo-ventral view (4C) or ventral view (5C); D, phallus; E, abdominal sternum VI, ventral view. Abbreviations as in text.

locality #583.2, ultraviolet light, 15–16 June 1987, S. W. Hamilton and K. M. Hoffman collectors, USNM.

PARATYPES: Same data as holotype, 32 males, 1 female, CUAC. Same data as holotype except 20–21 July 1987, 7 males, 1 female, USNM. Same data as holotype except Townes trap, 20–21 July 1987, 1 female, USNM.

ETYMOLOGY: "Para-" (Greek), meaning "near," and "limnella" from the species epithet of *Helicopsyche limnella,* the probable sister species, which is endemic to the Ozark Mountains.

DIAGNOSIS: According to Hamilton and Holzenthal (1984), six species of *Helicopsyche* were known previously from America north of Mexico. The male of this species most closely resembles the endemic Ozarkian species *H. limnella* Ross, 1938, in the sharply produced postero-dorsal corner of each inferior appendage and the somewhat stalked baso-mesal lobe on this appendage. However, the apical region of this appendage is narrower in this species; also, the anterior edge of the appendage is straight and its antero-dorsal edge is evenly rounded, rather than concave and angulate, respectively, as in *H. limnella.* Furthermore, this new species is smaller and darker than *H. limnella.* Males of no other North American species have tergum X parallel-sided in lateral view, but instead narrow distally.

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